

Space News Roundup

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No. 13

Discovery takes center stage Tuesday

STS-56 to study Sun's effects on atmosphere

By James Hartsfield

While *Columbia's* three main engines are being replaced, *Discovery* is taking center stage with a planned liftoff at 12:32 a.m. CDT Tuesday.

STS-56 Commander Ken Cameron, Pilot Steve Oswald, Mission Specialists Mike Foale, Ken Cockrell and Ellen Ochoa were scheduled to travel to KSC Saturday evening in preparation for the launch.

With an on-time launch, the first activity for the crew will be for Foale to power up the



Atmospheric Laboratory for Applications and Science-2 instruments. The instruments, mounted on a pallet in *Discovery's* cargo bay, are making their second shuttle flight and will make an array of measurements designed to study the chemical composition of Earth's upper atmosphere, including the Sun's effects on the atmosphere and measurements related to the creation and destruction of

ozone. In addition, the instruments are used to fine-tune similar instruments that are per-
Please see **STS-56**, Page 4

Valve problem traced to rubber-like contaminant

By James Hartsfield

Shuttle managers decided to launch *Discovery* on shuttle mission STS-56 prior to *Columbia's* flight on STS-55 early last week after problems with check valves in a purge lines on both vehicles were resolved.

While *Discovery* is set for launch at 12:32 a.m. CDT April 6, *Columbia*, carrying the German Spacelab D2 and two German Space Agency astronauts, is now planned for an April 24 launch.

"Flying the missions in this order is the most



effective use of all our resources," Shuttle Program Director Tom Utsman said. "The early April launch of the ATLAS 2 mission will give scientists the opportunity to observe changes in the Earth's ozone during the seasonal transition between spring and summer in the northern hemisphere.

"At the same time...NASA is very pleased with the cooperation given by our friends in the German Space Agency," he added. "They have been involved as all possible options have been considered.

Please see **ENDEAVOUR**, Page 4

Patient monitoring earns JSC spot in space hall of fame

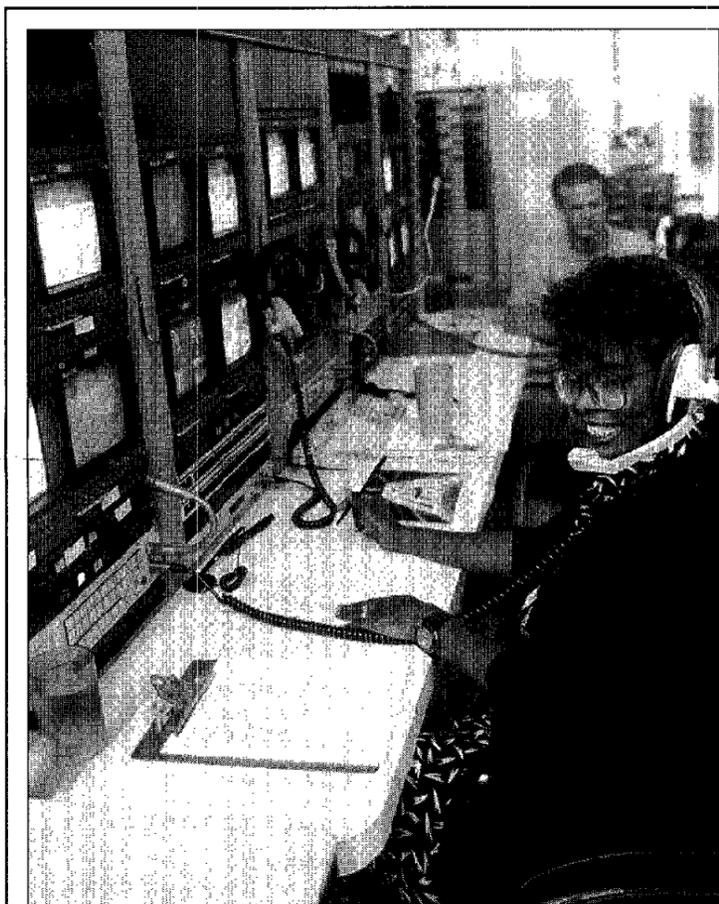
JSC will be inducted into the Space Technology Hall of Fame at this year's Ninth National Space Symposium next week in Colorado Springs.

JSC, along with other participating companies and individuals, will be recognized for its role in the successful development and commercialization of patient monitoring equipment.

"The selection of Hall of Fame inductions was made by a prestigious panel of nationally recognized judges," wrote John P. Flannery, executive director of the Space Technology Hall of Fame, in a letter to JSC Director Aaron Cohen. "They viewed patient monitoring equipment as an excellent example of a space technology application that has had a significant impact on the American public as well as the marketplace."

Patient monitoring equipment, which is used in ambulances and hospitals to help doctors prepare to receive incoming emergency patients and to monitor their condition once they are in the hospital, is an outgrowth of NASA technology that allows doctors on the ground to monitor astronauts' conditions while they are in orbit.

NASA Administrator Daniel S. Goldin will be the keynote speaker for the Hall of Fame Banquet during the National Space Symposium, which will be April 13-16 in Colorado Springs.



JSC Photo by Andrew Patnesky

JUST TESTING—Test Director Carolyn Fritz monitors conditions in the Weightless Environment Training Facility during a contingency extravehicular activity simulation. Although no space walk is planned on the upcoming STS-56 flight, Mission Specialists Ken Cockrell and Mike Foale have trained to help deploy the SPARTAN carrier by hand under certain conditions.

New Initiatives, Exploration Programs merge

Exploration effort shifts to Office of Space Science

JSC's New Initiatives Office and the Exploration Programs Office are merging in an effort to consolidate the center's focus on advanced programs and technology development, JSC Director Aaron Cohen said Friday.

The move was associated with NASA Administrator Daniel S. Goldin's recent announcement that the activities of NASA Headquarters' Office of Exploration will be absorbed by the Office of Space Science, effective immediately.

At JSC, William J. Huffstetler will continue to serve as manager of the New Initiatives Office, and under his leadership the office will be reorganized to respond to the changing needs of the center and the agency. Humboldt Mandell, formerly deputy manager of JSC's Exploration Programs Office, becomes deputy manager of the New Initiatives Office.

Details regarding the reorganization and other key personnel assignments will be issued as soon as the process is complete, Cohen said.

Huffstetler said the merged office

will have two primary customers at NASA Headquarters, the new Office of Space Science and the new Office of Advanced Concepts and Technology.

"The major emphasis will be to utilize the significant work accomplished by the Exploration Office at JSC to respond to the needs of the Space Science customer," Huffstetler said. "We will develop mission strategies and concepts that will provide the maximum science return, using the least complex technical and programmatic approaches that are the most affordable in terms of the significant budget constraints we face."

In addition, the merger will allow JSC to support the agency's efforts to develop technologies and concepts that are critical to the economic future of America.

In making his announcement, Goldin said the Office of Exploration move is being made in the interest of maintaining clear and well-defined management responsibilities. The exploration activities will be focused in a new organization.
Please see **LONG-RANGE**, Page 4

Evidence from Pioneer Venus points to oceans, lightning on Earth's 'twin' planet

The last findings by the Pioneer Venus Orbiter spacecraft have provided strong new evidence that planet Venus once had three and a half times more water as thought earlier—enough to cover the entire surface between 25 and 75 feet deep (762 and 2286 centimeters).

These findings also give new support for the presence of lightning on Venus and discoveries about the ionosphere and top of the atmosphere of Venus. Considered Earth's twin planet, Venus today is very dry and searing hot.

Pioneer entered Venus' atmosphere on Oct. 8, 1972, and burned up soon after, ending 14 years of exploration.

"Many of us have long thought that early in its history Venus had temperate conditions and oceans like Earth's," said Dr. Thomas Donahue, University of Michigan, head of the Pioneer Venus science steering group.

"Findings that Venus was once fairly wet do not prove that major oceans existed, but make their existence far more likely," he said. "The new Pioneer data provides evidence that large amounts of water were definitely there."

Most scientists think Venus' early oceans vaporized and "blew off" 3 billion years ago in a runaway greenhouse effect when the cool early Sun increased its luminosity and heated the planet. Solar ultraviolet radiation split the water molecules into hydrogen and oxygen, and the hydrogen was lost to space.

Pioneer Venus data showed a remarkably heavy hydrogen/deuterium ratio, which has since been confirmed by independent measurements, Donahue said.

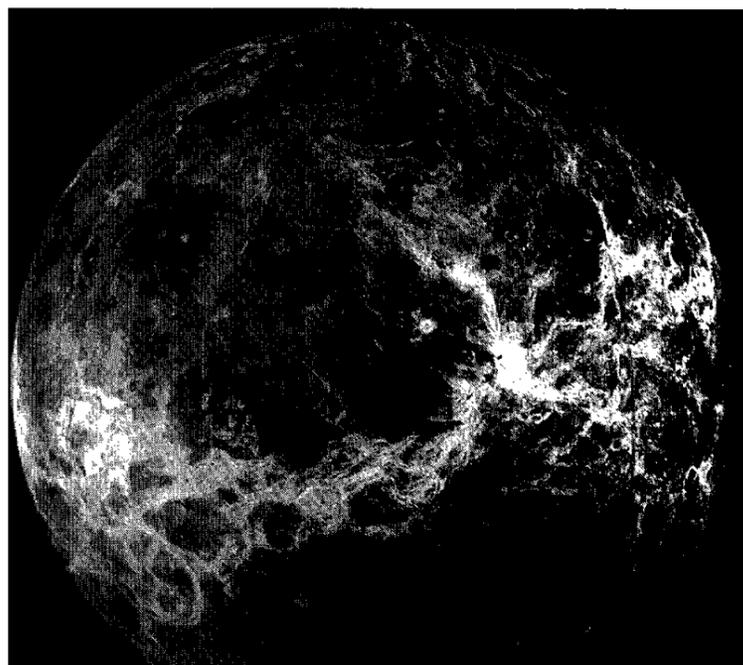
Abundant deuterium is taken as clear evidence that Venus once had 150 times as much water in its atmosphere as today. This is because the water's ordinary hydrogen has

escaped. But most of the water's heavy hydrogen (deuterium—twice as heavy as hydrogen) stayed behind because of its weight.

When the orbiter made its final descent to unexplored regions only 80 miles above Venus' surface, it found evidence for 3.5 times as much water as previously suggested.

"We found a new and important easy-escape mechanism, which accelerates hydrogen and deuterium away from the planet," he said. "This means that much more hydrogen had to escape to build up the present high deuterium concentration. A lot more hydrogen lost means a lot more water early on," he said.

The data also show that at Pioneer's lowest altitude 7 miles below the peak of Venus' ionosphere, "whistler" radio signals, believed generated by Venus' lightning, were the strongest ever detected. Pioneer has long measured such "lightning" signals.



NASA Photo

Today, Venus is dry and searing hot as shown in this mosaic image from Magellan's synthetic aperture radar. Scientists looking at the last findings of the Pioneer Venus Orbit now believe that at one time there was enough water to cover Venus' entire surface.

JSC

Ticket Window

The following discount tickets are available for purchase in the Bldg. 11 Exchange Gift Store from 10 a.m.-2 p.m. weekdays. For more information, call x35350 or x30990.

EAA Bluebonnet Trip (April 18, includes transportation, lunch, tours): \$22, limit 4 tickets per person.

EAA Rockets vs. San Antonio Spurs (April 10, 7:30 at the Summit): \$5.50. On sale until April 9.

EAA Astros vs. Cincinnati Reds, (May 7, 7:05 p.m.): \$9.50. On sale until April 19. EAA Easter Egg Hunt (10 a.m. to noon, April 10 at the Gilruth Center): Child, \$4; adult, \$1. On sale until April 7.

Astroworld Early Bird Special — Tickets purchased before May 31 and used before June 30 at \$15.95.

Fiesta Texas, San Antonio — Discount tickets: adult, \$18.35; child (4-11) \$12.75.

Space Center Houston — Discount tickets: adult, \$7.50; child (3-11) \$4.50; commemorative: \$8.75.

Metro tickets — Passes, books and single tickets available.

Movie discounts — General Cinema, \$4.50; AMC Theater, \$3.75; Loews Theater, \$4.

Entertainment '93 and Gold C coupon books, stamps, Walt Disney Club memberships, business cards, stamps and souvenirs also available.

Upcoming events: Deep Sea Fishing, April 17; Country and Western Dance, April 24; Galveston Home Tours, May 1, 2, 8 and 9.

JSC

Gilruth Center News

Sign up policy — All classes and athletic activities are first come, first served. Sign up in person at the Gilruth Center and show a badge or EAA membership card. Classes tend to fill up four weeks in advance. For more information, call x30304.

EAA badges — Dependents and spouses may apply for photo identification badges from 6:30-9 p.m. Monday through Friday. Dependents must be between 16 and 23 years old.

Defensive driving — Course is offered from 8 a.m.-4:30 p.m. April 17. Cost is \$19.

Weight Safety — Required course for employees wishing to use the Gilruth weight room is offered from 8-9:30 p.m. April 20. Pre-registration is required; cost is \$5.

Aerobics — High/low-impact classes meet from 5:15-6:15 p.m. Tuesdays and Thursdays. Cost is \$22 for eight weeks.

Exercise — Low-impact class meets from 5:15-6:15 p.m. Mondays and Wednesdays. Cost is \$24 for eight weeks.

Aikido — Martial arts class meets Tuesdays from 6:15-8 p.m. Cost is \$15 per month.

Volleyball / Basketball — Sign-ups will be held for the next season during the week of April 19. See flyers or call the Gilruth Center for additional information.

Self-defense workshop — Learn what you can do to be better prepared at a free self-defense workshop from 5-6 p.m. April 21. Call x30304 to reserve a seat.

Fitness program — Health Related Fitness Program includes medical examination screening, 12-week individually prescribed exercise program. Call Larry Weir, x30301.

JSC

Swap Shop

Swap Shop ads are accepted from current and retired NASA civil service employees and on-site contractor employees. Each ad must be submitted on a separate full-sized, revised JSC Form 1452. Deadline is 5 p.m. every Friday, two weeks before the desired date of publication. Ads may be run only once. Send ads to Roundup Swap Shop, Code AP3, or deliver them to the deposit box outside Rm. 147 in Bldg. 2. No phone or fax ads accepted.

Property

Sale: Camino So 3-2-2D, spacious family rm w/FPL, wetbar, both formals, master has cedar walk-in closet, \$81.7k OBO, FHA assum. 333-6246 or 480-3986.

Sale: 4-3-2D, study, game rm, lg scr porch, kitchen w/Jennaire, new ceramic tile, lg lot w/trees, pkg boat/motorhome, \$128.9k. Shirley, 335-0641.

Sale: Dickinson Bayou waterfront, 4-2-5-2, pool, 3/4 acre, WB, FPL, sec sys, volleyball/ horseshoe set-up, \$224k. x34354 or 337-1640.

Lease: CLC, 1 BR condo, micro, W/D connect, FPL, exercise rm, tennis, avail May 1. Jim Briley, 244-4632 or 488-7901.

Sale: Condo for Baylor student, decrease college expense/IRS write off. 334-3896.

Rent: University Trace condo, 1 BR, study, W/D, fans, 1 cpt exercise rm, new carpet, \$460/mo. 488-2946.

Lease: Pipers Meadow 3 BR, avail Apr 1, fenced yard, 2 car garage, \$795. 488-2946.

Sale: Sycamore Valley 3-2-2A, new carpet and vinyl, lg kitchen, formals, den, 1800 sq ft, \$74.9k. Ann Marie, 333-1700 ext 202 or 481-5465.

Sale: Piper's Meadow 3-2-2, oversz lot, private patio w/Jacuzzi, wood deck, \$82.5k. 280-0415.

Lease/Sale: Oakbrook West 3-2-2, pool, lg patio, DR, detached garage w/door opener, \$1025/mo. 480-3260.

Sale: '90 Fleetwood mobile home, 18x80 single wide, 2-2, 1350 sq ft, all appliances, cent H/A/C, \$23.5k, can be moved. 480-8252.

Sale: University Trace condo, 2-2-2cp, split BR plan on grnd floor, new carpet, vinyl, paint, wallpaper, miniblinds, FPL, W/D, refrig, \$38k. x31790 or 488-1720.

Rent: LC Pecan Forest, 3-2-2, very clean, no pets, \$795/mo. 554-6200.

Rent: Lake Travis cabin, private boat dock, cent A/H, fully equip, accom 8, fall and winter, \$325/\$90 wkly/daily/ 474-4922.

Rent: Galveston beach house, day/week, furn, cent A/C. Ed Shumilak, x37686 or 326-4795.

Rent: Galveston condo, furn, sleeps six, Sewall Blvd and 61st, Cable TV, pools, wkly/wknd/daily rates. Magdi Yassa, 333-4760 or 486-0788.

Rent: New Orleans condo in French Qtr, Jazz Festival Week, Apr 23-30, rooftop deck, furn, sleeps 4, \$500. 282-

6422 or 280-8927.

Cars & Trucks

'85 Mustang convert, low mi, blue w/tan top, V6, all pwr. BO. x30017.

'84 Nussan 300ZX 2 + 2, auto, A/C, stereo cass, cruise, elec mirrors, \$3500. 488-7771.

'82 Mercedes 300SD, silver, blue leather, loaded, ex cond, 148k mi, \$11.9. Randy, 996-8471.

'79 Datsun 280ZX, new paint, 92k mi, \$2200. x32458 or 333-9518.

'83 Volvo station wagon, auto w/overdrive, ex cond, \$2600 OBO. 339-1957.

'85 Honda Prelude, 90k mi, AM/FM/cass, ex engine, needs minor body work, \$3100, Debbie, x33038.

'85 Chevy S-10 Blazer, 25k mi on rebuilt engine, \$5500. 338-6246 or 480-3986.

'88 Holiday Alumalite, 35' motorhome, 29k mi, 454 Chev, 6.5 Onan gen, 2 roof A/C, hydraulic leveling jacks, rear qn sz bed, sleeps 7, new tires, \$34k nego. Joe, 283-6508 or 337-3696.

'92 Plymouth Voyager Grand SE, ex cond, \$13.5k. Sue, x37213 or (409) 935-8689.

'81 Chevy Caprice, brn, A/C, runs good, looks bad, 450 OBO. Sami, x33731.

'92 Ford Escort GT, 26k mi, 100k mi warr, premium sound, tint, rear defrost, \$10.5k. x37073 or 482-0699.

'92 Toyota Celica GT, 21k mi, 100k mi warr, loaded, sun roof, CD, \$13.5k. x37073 or 482-0699.

'89 T-bird SC, navy blue, loaded, leather interior, CD, 69k mi. \$10k. 283-1220.

'90 Toyota Corolla, 4 dr sedan, auto, AC/PS/PB, AM/FM, new tires, 50k mi, 100 mi warr, ex cond, \$6500. 480-7338.

'86 S-10 Blazer, Tahoe pkg, charcoal gray/ silver, loaded, new tires, ex cond, \$5k. Kathy, x37034 or 538-3231.

'86 Nissan 4x4 PU, king cab, AM/FM/cass, tint, ex cond, \$6000. 334-2335.

'59 Chevy PU for restoration or parts. 334-2335.

'82 T-bird, V6, auto, overdrive, A/C, PS, PB, trans rebuilt 2 yrs ago, recent brake job, \$1250. Kitty, x30572.

'91 Jeep Renegade, hardtop, A/C, loaded, red on blk, ex cond, 12k mi, \$15.9k. Tom, 244-1119 or 534-4958.

'90 Lincoln Towncar, signature series, white/ gray, loaded, car phone, low mi, \$18.9k. Tom, 244-1119 or 534-4958.

Boats & Planes

Stainless propeller for Johnson OB, 13.5 OB x 17 pitch, \$100. Andy, 332-9105.

Half interest in IFR P-35 Beech Bonanza, \$15k. Steve, 244-9625.

'88 Bayliner 1700 Capri ski boat, open bow, v-hull, conv top, 85hp OB, Magnum drive-on trlr, garaged, \$6k or trade for car. Ed, 486-0705.

JSC

Dates & Data

Today

Cafeteria menu—Special: chili and macaroni. Entrees: barbecue sliced beef, Parmesan steak, spare rib with kraut. Soup: French onion. Vegetables: ranch beans, English peas, mustard greens.

Tuesday

Computer Expo '93—JSC's Information Systems Directorate and the University of Houston-Clear Lake's Research Institute for Computing and Information Systems will host Computer Expo '93 from 8 a.m.-5 p.m. April 6 at the Gilruth Center. More than 40 exhibits and a variety of seminars and demonstrations will be presented free. For more information, call the ISD Products center x37575.

Cafeteria menu—Special: corned beef hash. Entrees: meatballs and spaghetti, liver and onions, baked ham with sauce. Soup: split pea. Vegetables: buttered cabbage, cream style corn, whipped potatoes.

Wednesday

Lunch and learn — The American Institute of Aeronautics and Astronautics' Automation and Robotics Technical Committee will meet at 11:30 a.m. April 7 in Gilruth Center Rm. 206. Dr. Reginald Berka, head of the Automation and Robotics Division's Robotic Development Section, will discuss "Control of Hyper-Redundant Manipulators in Space Development." For more information, call Zafar Taqvi at 333-6544.

Toastmasters meet—The Space-land Toastmasters Club will meet at 7 a.m. April 7 at the House of Prayer Lutheran Church. For more information, call Jim Morrison at 480-9793.

Astronomy seminar — The JSC Astronomy Seminar will feature an open discussion meeting at noon April 7 in Bldg. 31, Rm. 129. For more information, call Al Jackson at 333-7679.

Cafeteria menu — Special: barbecue link. Entrees: cheese enchiladas, roast pork and dressing. Soup: seafood gumbo. Vegetables: pinto beans, Spanish rice, turnip greens.

Thursday

Future Fest—The Houston Space, Science Fiction, Fantasy, Film and Art Festival will host Houston Future Fest April 8-11 at the Hyatt Regency Downtown. Guests will include science fiction authors Jerry Pournelle and George Alec Effinger. Pre-registration is \$20; call Matt Converse at 482-7132.

Society for Software Quality — The Society for Software Quality will meet April 8 at 5:30 p.m. at the Days Inn, NASA Road 1. Tom Franklin, a partner at Ernst & Young, will present "Software Quality in a Client-Server Environment." For more information, contact Felix Balderas at x31945.

Cafeteria menu — Special: chicken fried steak. Entrees: roast beef with dressing, fried perch, chopped sirloin. Soup: beef and barley. Vegetables: whipped potatoes, peas and carrots, buttered squash.

Friday

Cafeteria menu — Special: fried chicken. Entrees: fried shrimp, baked fish, beef stroganoff. Soup: seafood gumbo. Vegetables: okra and tomatoes, buttered broccoli, carrots in cream sauce.

Monday

Lunch and learn — The American

Institute of Aeronautics and Astronautics' International Activities Committee will host a lunch and learn meeting at 11:30 a.m. April 12 in Regents Park III, Rm. 214. Jim Oberg will discuss "Russian Space Vocabulary." For more information, call 282-4351.

Cafeteria menu — Special: meat sauce and spaghetti. Entrees: franks and sauerkraut, sweet and sour pork chop with fried rice, potato baked chicken. Soup: cream of potato. Vegetables: French beans, buttered squash, lima beans.

April 14

Toastmasters meet — The Spaceland Toastmasters Club will meet at 7 a.m. April 14 at the House of Prayer Lutheran Church. For more information, call Jim Morrison at 480-9793.

Astronomy seminar — The JSC Astronomy Seminar will feature an open discussion meeting at noon April 14 in Bldg. 31, Rm. 129. For more information, call Al Jackson at 333-7679.

Freedom Fighters meet — The Space Station Freedom Fighters will meet at noon and 5 p.m. April 14 in Rm. 160 of the McDonnell Douglas Tower, Space Center Blvd. and Bay Area Blvd. For more information, call David Cochran at 482-7005.

April 15

NCMA seminar — The JSC chapter of the National Property Management Association will host a seminar April 15 and 16 at the Gilruth Center. Three nationally recognized speakers will discuss liability and acquisition. For more information, call S. Hawsey at x36582, or R. Redford at x36535.

\$100. Cliff, x35477 or 534-4145. Technics dual-cass deck, blk, ex cond, \$90. Keith, 335-2514 or 286-9808. Cerwin Vega D9 speakers, 2, very efficient, ex cond, \$250. 486-8260. JVC GF-S 550 super VHS camcorder w/case and acces, uses super VHS or reg VHS tape, 2 spd 8X zoom, professional qual w/animation capability, was \$1660, now \$550. x34737.

Pets & Livestock

Cockapoo puppies, solid blk, fem, \$75; males, \$50. 996-0981.

Musical Instruments

Arbor electric guitar, Fender amp, ex cond, \$350. James, 286-1934.

Household

5 pc sectional w/rocker/recliner, green w/mauve, gray pinstripes, 1.5 yrs old, \$1250; 26.6 cu ft GE refrig w/blk face, side-by-side, 1.5 yrs old, \$1150. 244-1119 or 534-4958.

Couch and love seat, southwest colors, ex cond, \$250 ea; matching sofa and coffee table, leaded glass panel top, ex cond, \$100 ea. Scott, x35343.

Litton microwave oven, 650 watt, 0.8 cu ft, digital controls, 10 pwr levels, \$70. 992-5958 or 335-8539.

Chrome glass table w/6 chairs, ex cond, \$170; Sony CD player, \$50. x31864.

Antique European wall clocks, 1700's-1900's from Vienna, Austria, \$300 and up. Dick or Olga, 286-7811.

Simmons qn sz Hide-a-Bed sofa, good cond, \$150. 488-4069.

Blk marble base w/glass top table w/six cream upholstered chairs, \$600; Lifestyle treadmill, \$150. 334-1773.

Carpet, rust colored, good cond, 150 yds, \$3/yd. Mark, x38013 or 992-4132.

Bed frame, solid maple, short poster, dbl sz, \$150; wall mirror, 2' x 3' in ornate gold leaf frame, \$125; hardwood rocker w/red cushion seat, \$50. Gene, x30182 or 480-9580.

Light tan cordorouy-look sofa, ex cond, \$125; antique BR suit, full mattress and box spring, headboard, chest-of-drawers and dresser w/mirror and stool, \$500. x39267.

Octagon coffee table w/beveled glass top, 2 hexagonal end tables w/beveled glass top, \$150 all; Queen Anne coffee table, \$50. all ex cond. 283-6369.

GE washing machine, wht, \$100 OBO; Corningware cooktop 4-burner elec cook top, 21" x 36", \$75 OBO; dbl oven, elec, \$100 OBO, 488-6054.

JC Penny-GE microwave oven, 115V, 13 amps, ex cond, \$125. 482-5621.

Wanted

Want oak crib w/mattress and twin stroller w/reclining seats in good cond. Jeff, x31909.

Want girl's 24" and 20" bikes. 244-8147 or 337-4770.

Want 60- or 80-slide trays for an Argus slide projector. 488-0395.

Want drummer and bassist for hard rock jam session. James, 332-1129.

Want roommate to share 3-2-2 in LC, private 2 BR/bath, \$290/mo plus 1/2 util, avail May 1. Sharon, x33019 or 554-6741.

Want skaters to join Suburban Animals, in-line quad welcome. Mike, x36632 or Keith, x38024.

Want Nordic Track ski exercise machine. Currie, x34703 or 480-7796.

Want baby crib in good cond. x37611.

Want donated furniture, household goods, cookware, toys, etc for Vietnamese refugees, items can be picked up, receipts given. Mai Pham, x31786.

Miscellaneous

HK-91 rifle, \$1200. Steve, 244-9625.

Medical type lounge chair, used for dialysis, \$400. E. Rubenstein, x34807 or 532-2211.

President & First Lady membership, \$400. Jesse, 282-4248 or 946-4154.

Amerc Model 610 rowing machine, ex cond, was \$375, now \$179. Joe, 333-7357 or 944-6513.

Full sz matt, box spring, frame, \$125; 12 spd Ross road bike, \$150; CB radio, \$30; JVC stereo cass deck, \$100. David, x35464.

Baby stroller, dbl wide, good cond, \$70; single baby stroller, needs repair, \$10; acetylene torch w/cutting and 2 brazing heads, 50 ft hose, portable tanks, \$200 OBO. Ray, x30823 or 554-5434.

Covered boatslip w/elec hoist located at Mariner Village on NASA Rd 1, \$8500. 474-4177.

Exercise bike, \$20; treadmill, needs work, \$100; wood computer chair, \$5; man's nuggett wedding ring, was \$1000, now \$600; 2 Compaq computers, 256, 2 FD, \$200 ea. Sue, x37213 or (409) 935-8689.

Motor jack hoist, 8 tons, like new, \$150 OBO. 282-4091 or 996-1106.

Soloflex w/leg extension, 1 yr old, \$1000. Phil, 244-8255.

Antique chess set, carved from sandalwood, big pieces, chessboard. \$275. 283-1220.

Salon-style tanning lamp panel, roll-around, swivel, timer, like new, was \$600, now \$200. Bob, 484-0898.

Sears 7 hp Craftsman riding mower, 26" cut, ex cond, \$350. Ruben, 486-8653.

SPA 8 ft acrylic spa, brown marble, 5 adjustable jets, air blower, light and cover. 486-5239.

Sears Eager-1 lawnmower, works well, \$35; women's Fuji 10 spd bike, \$100; lg dog carrier, \$20; Smith-Corona elec typewriter, ex cond, \$35. Lisa, x47479 or 480-3859.

Demanding Deadline

JPL scientists meet timeline challenge to focus Hubble's eyesight

By Diane Ainsworth
Jet Propulsion Laboratory

When push came to shove in December 1991, and JPL's Dr. James Fanson was asked to investigate the feasibility of building three Space Telescope moveable fold mirrors for the Hubble's new Wide Field/Planetary Camera, he decided to go for broke.

"There was no tried-and-true way to solve the problem we had discovered with the Hubble telescope's primary mirror," he said. "We discovered that correcting the imaging performance of the Hubble would require 10 times more precise optical alignment than it did for the WF/PC-1 camera. So we set out to build a set of articulating fold mirrors inside the camera that we could adjust from the ground to realign images.

"We were up against the tightest deadline we've ever had," Fanson said. "We needed to design and build the articulating mirrors in less than 10 months, and we had to build the control electronics in less time than it normally takes just to procure the parts.

"But JPL took some bold measures to ensure that our work was high priority and every procedure was completed as quickly as possible," he said. "If ever there was a case-in-point of JPL's ability to build something faster, cheaper and better, this was it."

Fanson assembled his JPL team and hit the ground running.

"We quickly realized that to

meet the performance requirements for these new mirrors, we needed to use new technology ceramic actuators that were developed by Litton/Itek Optical Systems for the Department of Defense," he said. "The JPL procurement people got Itek on contract with us in less than four weeks."

Fanson and his team next identified the solution that would correct and bring images into focus from the Hubble telescope's 8-foot-diameter (2.4-meter) primary mirror.

"Basically what's going on inside the camera is that we're canceling the error in the Hubble primary mirror with a matching error intentionally polished onto a mirror in WF/PC-2," he said. "This cancellation is straightforward in theory, but is made difficult in practice because of the large magnitude of the error. It's like trying to subtract a large number from another large number and coming up with zero. This only works if the Hubble is exactly aligned with WF/PC-2, and that's the job of the new articulating fold mirrors."

Light entering the camera is split into four quadrants by the pyramid mirror before reaching the relay secondary mirror. The newly shaped secondary mirror, which is the size of a dime, is where the cancellation of the Hubble error actually occurs. Light then continues on to the camera's charge-coupled devices, where the image is formed.

Fanson, along with Bob Bamford and Paul MacNeal of JPL's Applied Technologies Section, decided that they

would have to replace the "fixed"—unmoveable—fold mirrors in the camera with articulated, adjustable mirrors that could be tipped and tilted to make sure the light beam fell precisely in the middle of the secondary relay mirrors. Not only would that alignment capability be necessary after the vibrations and jitters of launch and installation, Fanson said, but it would be a means of guaranteeing on-orbit alignment in later months.

"The trick was to come up with a design that would fit in a very tiny space, less than 9/10ths of an inch thick and 1.6 inches in diameter," he said. "The parts are so small that they were assembled under a microscope."

Changes in mirror position are accomplished by each mirror's tilt mechanism. The tilt mechanism is like a three-legged stool, Fanson explained. The legs are composed of tiny ceramic actuators that lengthen when a voltage is applied to them.

"By controlling the lengths of the three legs, we can control the tip and tilt of the mirror," Fanson said. "We are talking about very small motions—the total stroke of the actuators is equal to the length your hair

grows in 15 minutes." The amount of voltage applied to the actuators is programmed by computers at the ground operations facility at Goddard Space Flight Center in Greenbelt, Md.

After assembly at JPL and Itek, the mirrors went

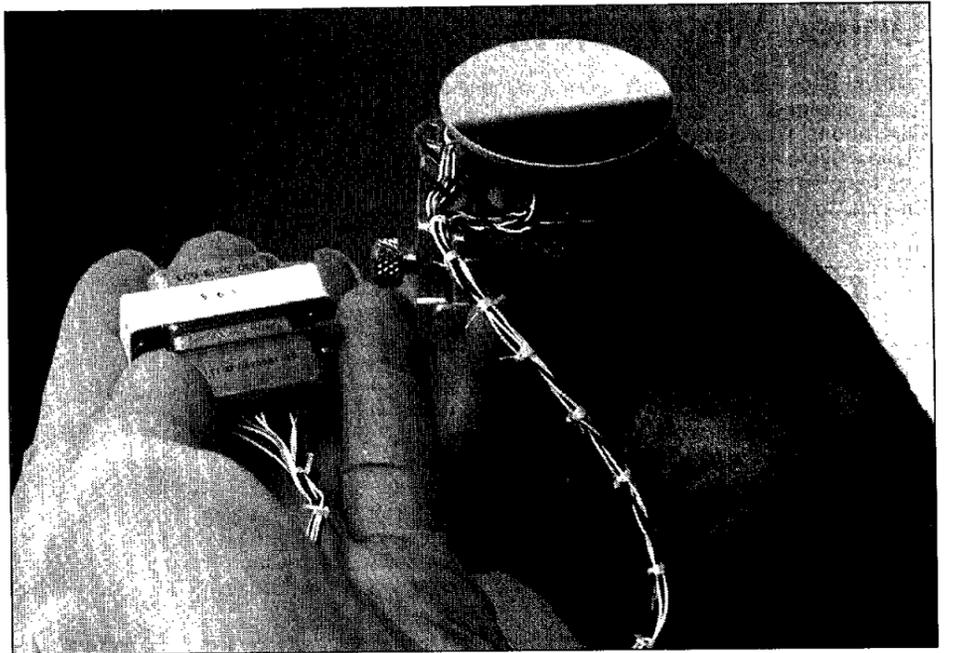
through environmental testing. When specifications were met, they were delivered to the WF/PC-2 integration and test team in early July—with two days to spare in the schedule. Meanwhile, work also was under way to build an extremely stable set of control electronics to command the 18 actuators in the three articulating mirrors.

"We made it in the nick of time, but we made it," said Fanson, who was awarded a 1992 Lew Allen Award for the articulating fold mirror effort. "We came in under budget and on time."

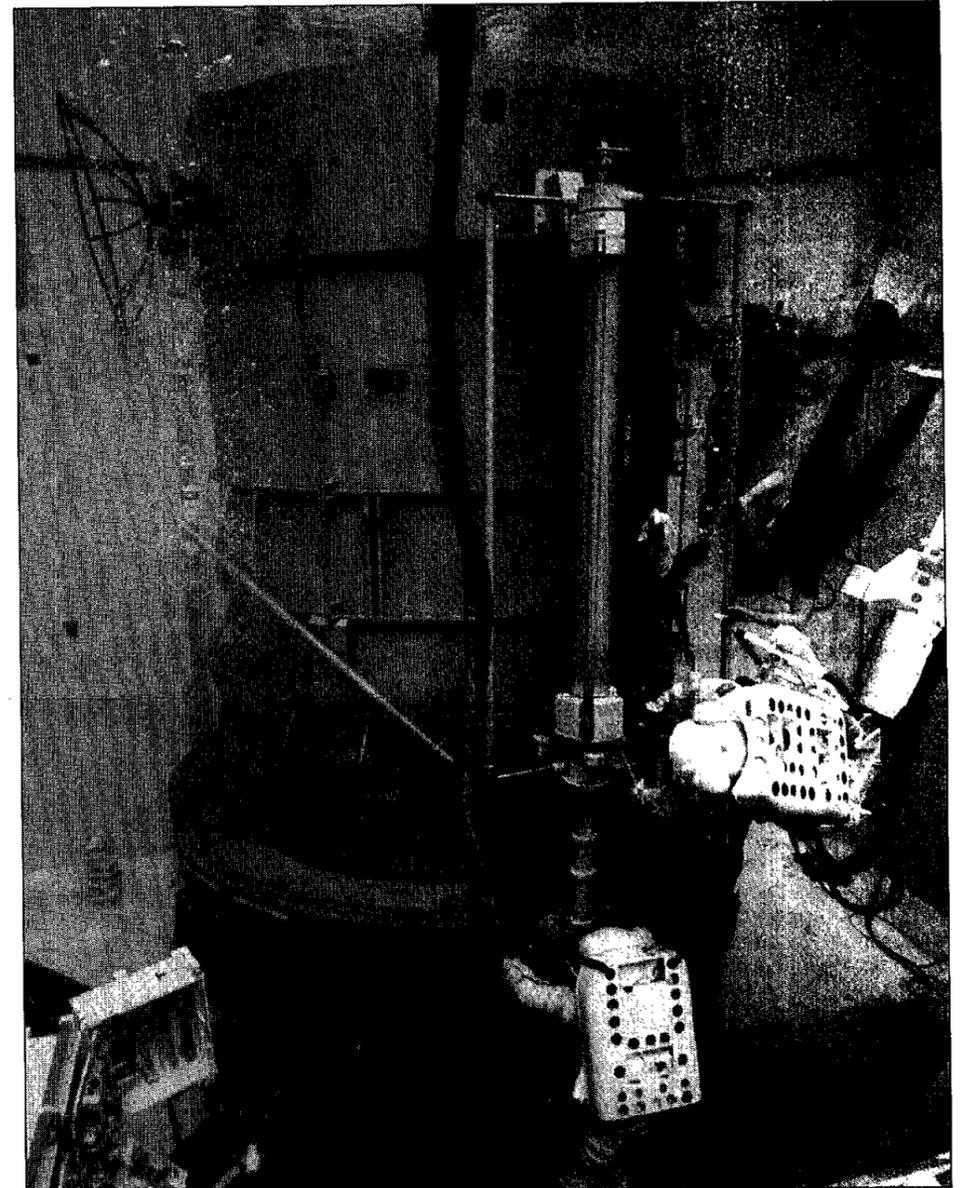
Launch of the Hubble Space Telescope servicing mission, STS- 61, is tentatively scheduled for Dec. 2, 1993, aboard the space shuttle *Endeavour*. Installation of the new Wide Field/Planetary Camera will occur on the second day of astronaut extra-vehicular activities, said Michael Devirian, WF/PC-2 deputy program manager and head of servicing and operations.

Adjustments to the camera and other instruments will take about a month, Devirian said. Ground-controllers will have to wait three weeks before they can turn on the coolers to bring the camera sensors down to about minus-80 degrees Centigrade. Then they will begin taking photographs, analyzing the images and fine-tuning the new articulating fold mirrors. □

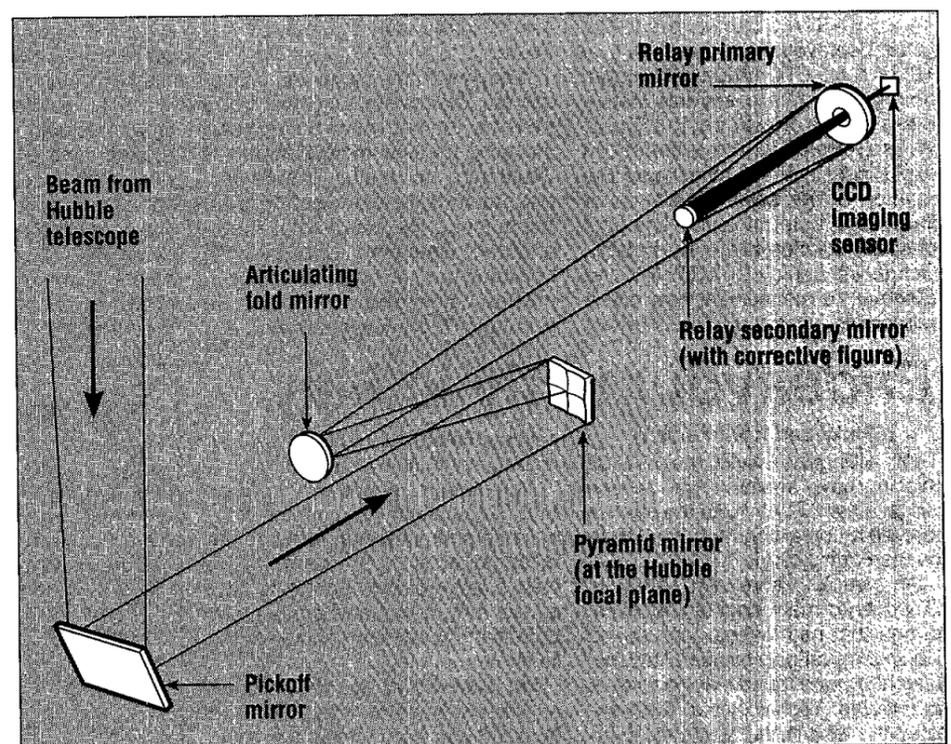
[Editor's note: Article reprinted with permission of Jet Propulsion Laboratory's Universe.]



Three tiny articulating fold mirrors will realign the incoming light to make sure the beams fall precisely in the middle of the secondary relay mirrors.



STS-61 crew members practice the complex extravehicular activities that include the installation of the new Wide Field/Planetary Camera.



An optical schematic diagram of one of the four channels of WF/PC-2 shows the path taken by beams from the Hubble Space Telescope before an image is formed at the camera's charge-coupled devices.

United Way honors JSC engineer who volunteered

David Beckman, an avionics systems engineer in the Mission Operations Directorate's Space Station Systems Division, recently was honored by the United Way of Brazoria County.

Beckman was one of six volunteers who received the vice presidents' awards at the United Way of Brazoria County's annual meeting.

Station's Elliott earns DAR Medal of Honor

Jerry Elliott, a configuration engineer in the Space Station Projects Office, recently received a national award during the Texas State Daughters of the American Revolution Annual Convention.

The national award, the DAR Medal of Honor, was presented in Houston on March 20.

Elliott was recognized as "an adult native-born American citizen who has displayed leadership, trustworthiness, service and patriotism to his country."

Krishen's conference gets leadership award

A conference program designed by Dr. Kumar Krishen, chief technologist in JSC's New Initiatives Office, recently won the Leadership in Action Award from Leadership Houston.

The Third International Conference and Exhibition of the World Congress on Superconductivity was honored in the international/corporate category for its notable contributions toward the betterment of life in the greater Houston area during 1992.

"JSC has been a driving force behind the WCS in the area of organizing the conference and exhibition," Krishen said. "I am delighted to see our work being recognized through the forum which is aimed at promot-



Beckman

Elliott

Krishen

Chauvin

ing leadership in Houston for national benefit."

Chauvin top secretary

Linda W. Chauvin, secretary to the manager of New Initiatives' Space Shuttle and Space Station Freedom Payloads Project Office, has earned the Marilyn J. Bocking Award for Secretarial Excellence.

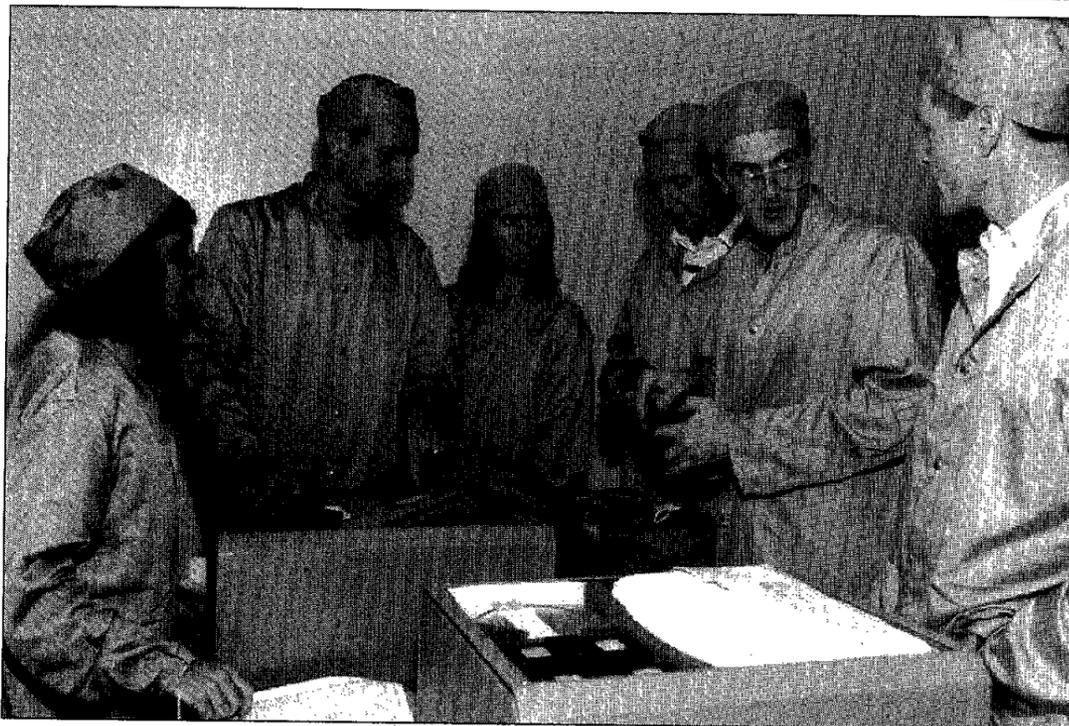
Chauvin, who works for both the division and the Project Development

Branch, supports a staff of 21 civil servants and more than 300 contractors that work on an average of five shuttle missions a year.

In addition to shepherding some 1,500 letters a year through proper channels, Chauvin serves as the classified materials custodian, coordinator of telecommunications, energy conservation and the office's recent move to Bldg. 4S. She also serves on the New Initiatives Office's Q+ Team.

People

Beckman was honored as a "diligent, hard-working volunteer" for the group's planning and allocations committees by Glenn Taylor, the organization's vice president of planning. Beckman, a Pearland resident, has been a member of the group's board of directors since 1991.



JSC Photo by Benny Benavides

LENS CHECK—During the standard bench review of all equipment, STS-57 crew members discuss the camera equipment they'll be using. From left are Mission Specialist Nancy Sherlock, Commander Ron Grabe, Mission Specialist Janice Voss, Pilot Brian Duffy, Mission Specialist Jeff Wisoff and Payload Commander G. David Low.

STS-56 first five-person, 24-hour crew

(Continued from Page 1)

manently in orbit aboard unmanned satellites such as the Upper Atmosphere Research Satellite.

Complementing measurements made with the ATLAS-2 instruments will be the Shuttle Solar Backscatter Ultraviolet instrument, a device that measures the amounts of ultraviolet light reflected off the atmosphere, and the Solar Ultraviolet Experiment, an experiment designed, built and run by students at the University of Colorado-Boulder that will measure solar radiation and its effects.

Another major experiment aboard *Discovery* will be mounted on a SPARTAN carrier, a satellite to be deployed from the shuttle at 12:37 a.m. CDT Friday. Mounted on SPARTAN are several instruments that compose the Solar Wind Generation Experiment, an experiment that will investigate the relation of the solar wind to solar flares and determine the amounts of solar radiation in low Earth orbit. Ochoa will deploy SPARTAN using *Discovery's* mechanical arm and it will remain away from *Discovery* for

about 50 hours before Cameron completes a rendezvous with the satellite and Ochoa captures and berths it back in the cargo bay.

Activities with the ATLAS-2 instruments will be overseen from the Payload Operations Control Center at the Marshall Space Flight Center in Huntsville, Ala., and *Discovery's* crew will work in two shifts—the first five-member shuttle crew to do so—to provide 24-hour-a-day operations onboard. Keeping mostly morning hours Houston time will be the Blue Team, composed of Cameron, Oswald and Ochoa. Keeping evening hours according to Houston clocks will be the Red Team, composed of Cockrell and Foale.

Along with the cargo bay instruments, *Discovery* also will carry several in-cabin experiments, including the Commercial Materials Dispersion Apparatus; the Physiological and Anatomical Rodent Experiment; the Hand-held, Earth-oriented, Real-time, User-friendly, Location-targeting and Environmental System; the Shuttle Amateur Radio Experiment-II; the

Space Tissue Loss experiment; the Cosmic Radiation Effects and Activation Monitor; and the Radiation Monitoring Equipment.

CREAM and RME measure various amounts of radiation in the crew cabin.

STL is an experiment that measures the effect of weightlessness on bone tissue cell samples.

SAREX-II is a ham radio carried aboard *Discovery* that the crew will use to speak with ham radio operators worldwide as well as several school classes.

HERCULES is a Department of Defense-developed camera that imprints the latitude and longitude of a photograph of Earth taken by an astronaut on the film at the time the photo is taken.

PARE explores the effect of weightlessness on bone tissue in rodents, and CMIX is a device that allows various crystal and metal samples to be investigated in orbit.

An on-time launch means *Discovery* will be scheduled to land at the Kennedy Space Center at about 6:38 a.m. CDT next Wednesday.

Space News Roundup

The Roundup is an official publication of the National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Texas, and is published every Monday by the Public Affairs Office for all space center employees.

Dates and Data submissions are due Wednesdays, eight working days before the desired date of publication.

Editor Kelly Humphries
Associate Editor Kari Fluegel

Project IQ offers JSC employees study opportunity

JSC employees who are interested in upgrading their job skills by pursuing undergraduate college study during working hours have until April 30 to sign up for the Project Increased Qualifications Program.

The two-year program provides JSC employees with the opportunity to take up to three college courses per semester during duty hours, not to exceed eight hours per week. JSC pays training costs including tuition, required course fees and textbooks.

"Project IQ is designed to assist selected JSC employees in improving their skills and qualifications and enable them to be more productive in their present positions. It is also designed to provide opportunities for employees to become better qualified for positions to which they may reasonably aspire," said Susan Braymer, Human Resources Development Branch chief.

An applicant must be a permanent

employee with at least one year of continuous civilian service, be in a nonprofessional position in grades GS-1 through GS-11 and have completed at least six semester hours of college level work, preferably within the last two years. Employees who already possess a bachelor's degree are not eligible.

Project IQ selection criteria include written recommendations from the employee's immediate supervisor, a brief statement of the applicant's academic purpose, the applicant's success in previous college course work, the level of activity in the employee's office and the applicant's own workload.

Project IQ applications are available in the Human Resources Development Branch in Bldg. 45, Room 146 or can be mailed by calling Laura Goerner at x33067. For more information about Project IQ, contact Paige Maultsby at x33075.

Space Center Houston needs volunteers

Space Center Houston currently is calling for JSC volunteers to help with educational programs at the new visitor center.

Since Space Center Houston opened, the School Visit Program has brought an overwhelming response from the educational community, said Sharon Tidwell, educational programs assistant.

To support the visits, the Educational Programs Office is enlisting a corps of volunteers who devote a few hours in the morning to shep-

herd small groups of school children through the center and help with clerical tasks and other projects.

"It's great when a program is so successful that you have to bring in more folks to cover the demand," Tidwell said. "And our volunteers have a great time too. We have several retired teachers, former space industry professionals and college students already on the rolls."

For more information, contact the Educational Programs Office at 244-2145.

Mission Control, cafeteria hours set

The Mission Control Center viewing room will be open to JSC and contractor badged employees and their families during portions of the STS-56 mission.

Based on a Tuesday launch, employees will be allowed to visit the MCC Wednesday, Thursday and Friday, from 11:30 a.m.-2:30 p.m. and 5-7 p.m.; Saturday, from 2-4 p.m.; and April 12 and 13, from 11:30 a.m.-2:30 p.m. and 5-7 p.m.

Children under 5 will not be per-

mitted. No flash photography or loud talking will be permitted at any time. Viewing hours may change without notice. For the latest information on the schedule, call the Employee Information Service at x36765.

Special cafeteria hours also will be in effect during the mission.

The Bldg. 11 cafeteria will be open from 6:30 a.m.-2 p.m. weekdays, except launch and landing days. The Bldg. 3 cafeteria will be open normal hours from 7 a.m.-2 p.m. weekdays.

Endeavour to fly in May

(Continued from Page 1)

Their willingness to let the STS-56 mission have an early April launch will give the ATLAS folks the chance to collect some very important data on the Earth's ozone."

A check valve on one of *Discovery's* main engines, identical to one that had leaked and caused *Columbia's* on-pad engine shutdown March 22, was found leaking when it was tested. Technicians at KSC isolated the leak to the single valve on *Discovery* and it was replaced.

Analysis showed *Columbia's* valve problem was due to a piece of rubber-like contamination caught in the valve seat. A similar problem is

believed to be the cause of the leak in *Discovery's* removed valve.

The check valves are in lines that feed helium through the main engines prior to launch to purge the internal engine plumbing. The valves close before ignition to shut off the helium flow and prevent any propellant gases from getting in the lines.

On *Columbia*, the three main engines are being removed and replaced with engines that had been destined for *Endeavour*. The engines that were on *Columbia* during the abort will be refurbished and installed in *Endeavour* in time for a launch of STS-57 in late May.

Long-range exploration goals placed on back burner for now

(Continued from Page 1)

tional unit as a division of the Office of Space Science.

"The Office of Exploration has provided a needed focus for the agency's vision of the future," Goldin said. "But it is only practical that further studies on human expeditions to the Moon and Mars complement and build on the more near-term robotic missions."

Associate Administrator for Exploration Michael D. Griffin, has been reassigned as the agency's chief engineer.

"Dr. Griffin and his organization

have served NASA well in charting a course for the future," Goldin said. "The redesigned space station and our robotic missions are the beginning and must be our priority tasks in the near term."

The Office of Space Science was created as part of a series of organizational changes announced March 11.

At that time, it was identified as the Office of Planetary Science and Astrophysics. The Office is headed by Dr. Wesley J. Huntress Jr., associate administrator for space science.